What is claimed is:

1. A method for fabricating a catalyst layer for a fuel cell, comprising:

preparing a catalyst material for either the electro-reduction or electro-oxidation reaction in the fuel cell;

introducing a substance in the catalyst material, wherein the substance is insoluble in the catalyst material; and

subsequently removing the insoluble substance from the catalyst material to increase a surface area of the catalyst material compared to the catalyst material prior to introducing and removing the substance.

2. The method as in Claim 1, wherein the catalyst material comprises a catalyst of about 7-10 wt.%, perfluorovinylether sulfonic acid of about 60-70 wt.%, and polytetrafluoroethylene of about 15-20 wt.%.

3. The method as in claim 2 wherein the catalyst material is obtained by:

mixing the catalyst and the polytetrafluoroethylene in a diluted solution to form a mixture liquid;

performing sonication to the mixture liquid;

subsequently adding the perfluorovinylether sulfonic acid in a diluted solution to the mixture liquid to form a new mixture liquid; and

performing sonication to the new mixture liquid.

4. The method as in claim 2, wherein the catalyst comprises platinum and ruthenium.

5. The method as in claim 1, wherein the insoluble substance is a surface active substance which prevents particle agglomeration and is volatilized at a high temperature.

6. The method as in claim 5, wherein the surface active substance is a non-ionic surfactant.

7. A method for fabricating a catalyst material for a fuel cell:

mixing a catalyst and a polytetrafluoroethylene in a diluted solution to form a mixture liquid;

performing sonication to the mixture liquid;

subsequently adding a perfluorovinylether sulfonic acid in a diluted solution to the mixture liquid to form a new mixture liquid solution;

performing sonication to the new mixture liquid solution; and

placing dry ice into the new mixture liquid to evaporate the liquid portion without agglomeration and growth of particles to form a catalyst material.

8. The method as in Claim 7, wherein the catalyst material comprises the catalyst of about 7-10 wt.%, the perfluorovinylether sulfonic acid of about 60-70 wt.%, and the polytetrafluoroethylene of about 15-20 wt.%.

9. A method for fabricating a catalyst material for a fuel cell:

mixing a catalyst and a polytetrafluoroethylene in a diluted solution to form a mixture liquid;

performing sonication to the mixture liquid;

subsequently adding a perfluorovinylether sulfonic acid in a diluted solution to the mixture liquid to form a new mixture liquid solution;

performing sonication to the new mixture liquid solution; and

adding a gas through the new mixture liquid solution to cause bubbles to promote formation of a foam-type catalyst

material.

10. The method as in Claim 9, wherein the catalyst material comprises the catalyst of about 7-10 wt.%, the perfluorovinylether sulfonic acid of about 60-70 wt.%, and the polytetrafluoroethylene of about 15-20 wt.%.

11. The method as in claim 9, wherein the gas is an inert gas, nitrogen, or air.

12. A method for fabricating a catalyst material for a fuel cell, comprising:

mixing a catalyst of about 7-10 wt.%, a perfluorovinylether sulfonic acid of about 60-70 wt.%, and a polytetrafluoroethylene of about 15-20 wt.% to form a catalyst material; and

thermally quenching the catalyst material from a high temperature to a low temperature to activating the catalyst material.

13. The method as in claim 12, wherein the thermal quenching is performed in a liquid nitrogen to decrease the temperature from an ambient temperature to about 77K.

14. The method as in claim 12, wherein the catalyst comprises platinum and ruthenium with a relative percentage ratio from about 10 wt.% platinum and 90 wt.% ruthenium to about 90 wt.% platinum and 10 wt.% ruthenium.

15. A catalyst material for a fuel cell, comprising:

a catalyst comprising tungsten carbide;

a perfluorovinylether sulfonic acid; and

a polytetrafluoroethylene.

16. The material as in claim 15, wherein said catalyst further includes ruthenium or ruthenium oxide.

17. The material as in claim 16, wherein said catalyst further comprises platinum.

18. A catalyst material for a fuel cell, comprising:

a catalyst comprising zirconium dioxide;

a perfluorovinylether sulfonic acid; and

a polytetrafluoroethylene.

19. The material as in claim 18, wherein said catalyst

further comprises platinum.

20. The material as in claim 19, wherein said catalyst further comprises ruthenium dioxide.

21. A catalyst material for a fuel cell, comprising:

a catalyst comprising zeolites incorporated with platinum and ruthenium;

a perfluorovinylether sulfonic acid; and

a polytetrafluoroethylene.

22. The material as in claim 21, wherein said catalyst further includes iridium in said zeolites.

23. The material as in claim 21, wherein said catalyst further includes osmium in said zeolites.

24. The material as in claim 21, wherein said catalyst further includes tungsten in said zeolites.

25. The material as in claim 21, further comprising an electrically-conductive carbon material.